Original Article - Comparative Study

Treatment of maxillary cleft palate: Distraction osteogenesis vs. orthognathic surgery

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ABSTRACT

Purpose: The purpose of this paper is to compare the treatment of hypoplastic, retruded maxillary cleft palate using distraction osteogenesis vs. orthognathic surgery in terms of stability and relapse, growth after distraction and soft tissue profile changes. **Materials and Methods:** The cleft patients showed anteroposterior maxillary hypoplasia with class III malocclusion and negative overjet resulting in a concave profile according to preoperative cephalometric measurements, dental relationship, and soft tissue analysis. The patients were divided in two groups of treatment: Seventeen were treated by orthognathic Le Fort I osteotomy fixed with four mini plates and 2 mm screws, and 19 were treated by maxillary distraction osteogenesis with rigid extraoral devices (RED) connected after a Le Fort I osteotomy. The rate of distraction was 1 mm per day to achieve Class I occlusion with slight overcorrection and to create facial profile convexity. Following a 10 week latency period the distraction devices were removed. **Results:** In the RED group the maxilla was advanced an average of 15.80 mm. The occlusion changed from class III to class I. The profile of the face changed from concave to convex. At a 1-year follow up the results were stable. The mean orthognathic movement was 8.4 mm. **Conclusion:** In mild maxillary deficiency a one stage orthognathic surgery is preferable. However, in patients requiring moderate to large advancements with significant structural deficiencies of the maxilla or in growing patients the distraction technique is preferred.

Key Words: Distraction osteogenesis, cleft palate, micrognathism

INTRODUCTION

Maxillary hypoplasia in cleft lip and palate deformities results from congenital reduction in midfacial growth and the effects of the surgical scar from cleft lip and palate repair.[1,2] Maxillary advancement includes maxillary osteotomy and miniplate fixation, along with interpositional bone grafting[3-7] to improve support and prevent relapse.[3-6] Distraction osteogenesis was developed by Ilizarov for limb elongation following corticotomy without need for bone grafting.[8,9]

In facial bones the method was proved predictably in animal studies,[10,11] with generation of new bone, and is now used in clinical practice.[12-15]

The purpose of this article is to present our experience using conventional orthognathic surgery vs. distraction osteogenesis for maxillary cleft deficiency, in terms of stability and relapse.

MATERIALS AND METHODS

The patients were divided in two groups of treatment: The first group was treated by Orthognathic Le Fort I osteotomy, and the second group was treated by maxillary distraction osteogenesis.

Maxillary distraction was performed on 19 cleft patients presenting with maxillary retrusion with rigid extraoral devices (RED). The RED technique used a halo anchored to the skull by special fixation screws. An external adjustable distraction system was attached to the halo.

Conventional Le fort I osteotomy was performed to 17 retruded cleft patients with anteroposterior maxillary hypoplasia with class III malocclusion and negative overjet resulting in a concave profile [Figures 1 and 2]. The preoperative cephalometric measurements, dental relationship, and soft tissue analysis, revealed the anteroposterior maxillary hypoplasia [Figure 3].

Under general anesthesia with naso-endotracheal intubation the maxilla was osteotomized at a Le Fort I level and down fracture was performed. The rigid extraoral distraction (Polley/ RED II System, Rigid External Distraction, KLS Martin, Tuttlingen, Germany) device was connected by the halo portion to the skull with three or four scalp screws on each side. From the halo a vertical bar was connected to the maxillary teeth [Figure 4]. The rate of distraction was 1 mm per day for as long as was necessary to achieve Class I occlusion with slight overcorrection and to create facial profile convexity. The latency period was 10 weeks following which the distraction devices were removed. The extraoral RED devices were removed by unscrewing of the fixation screws.

The orthognathic group comprised 17 patients who underwent Le Fort I advancement with slight downward rotation and fixation with four internal fixation mini plates.

RESULTS

The results demonstrated greater maxillary advancement using distraction osteogenesis method with improved stability over time and further maxillary growth in growing patients [Figure 5a–c]. The mean maxillary anterior movement measured by dental overjet was 15.80 mm using the RED system. The profile of the face changed from concave [Figure 1b] to convex [Figure 5c]. Intraoral views [Figure 6] and lateral cephalometric radiograph [Figure 7] demonstrated the marked advancement of the maxilla. At 1 year follow up, the results were stable.

In the orthognathic group, the occlusion changed from Class III to Class I and the mean orthognathic movement was 8.4 mm. The cephalometric X-rays demonstrated the maxillary advancement and profile correction.

Figure 1: Anterior (a) and lateral (b) view of 18-year-old patient with maxillary deficiency and class III malocclusion

Figure 3: Preoperative lateral cephalometric radiograph

Figure 2: (a, b, and c) Intraoral view of the class III malocclusion

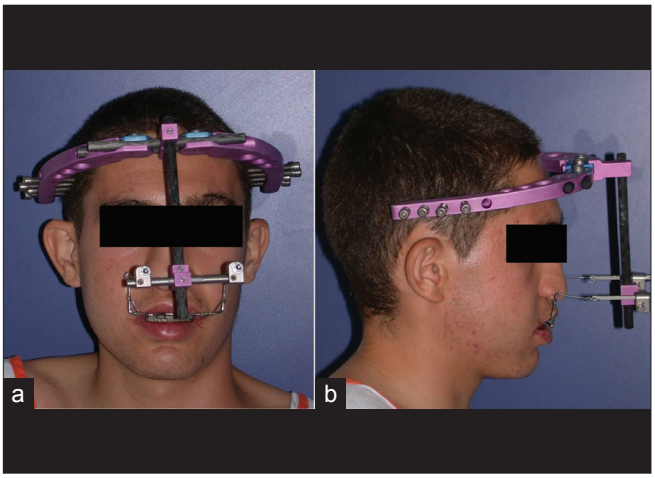

Figure 4: Anterior (a) and lateral (b) views of the patient during treatment with the rigid external distraction system. The halo was affixed to the skull with scalp screws on either side. The vertical bar was connected to the halo. The horizontal bar was connected by wires to the traction hooks using two distraction screws

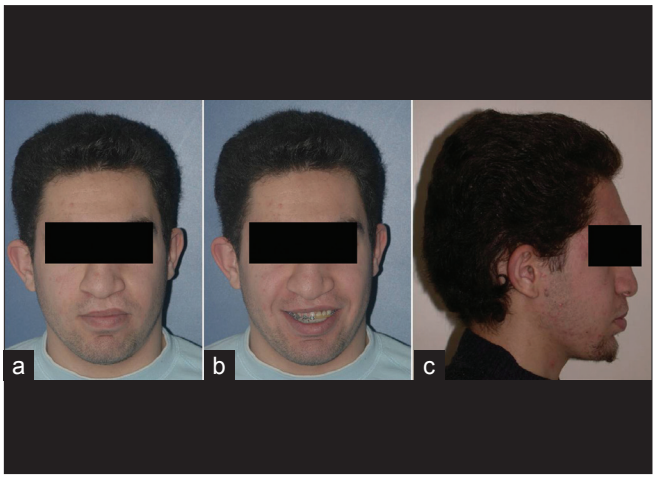

Figure 5: Anterior (a and b) and lateral (c) views at the end of treatment, after removal of the device and correction of maxillary deficiency and malocclusion

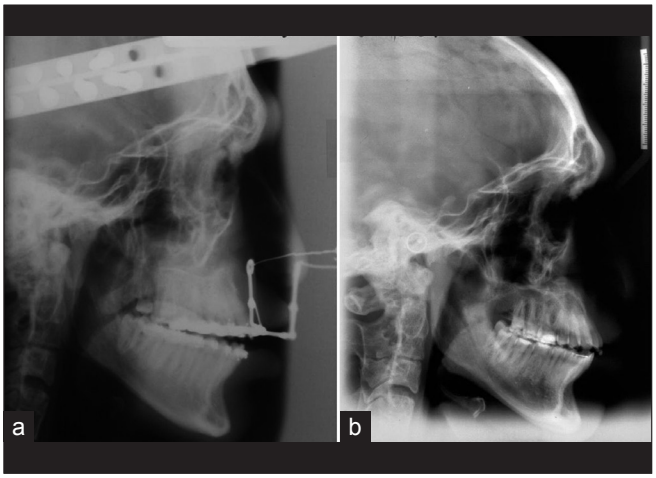

Figure 7: Lateral cephalometric radiograph during the distraction (a) and postoperatively (b) showing marked advancement of the maxilla

In cases of mild maxillary deformities without significant bone deficiency a one stage orthognathic surgery gave satisfactory results. In moderate or severe maxillary deficiency or in growing patients the distraction methods have showed advantages over conventional orthognathic surgery in terms of greater maxillary movement, skeletal stability, and soft tissue profile changes.

DISCUSSION

The maxilla in cleft lip and palate patients is often difficult to mobilize due to scarring from previous operations in the soft or hard palate or lip closure. The hypoplastic maxilla is usually advanced by one of the Le Fort osteotomies, with or without additional bone grafting in order to re-establish facial balance and occlusion.[4,5] Newly formed bone can provide good support and thus contribute to stability. Disadvantages of autogenous bone grafting include potential donor site morbidity, resorption, and infection of the bone graft[16] with a tendency to relapse caused by decreased bone support of the maxilla after resorption or infection.

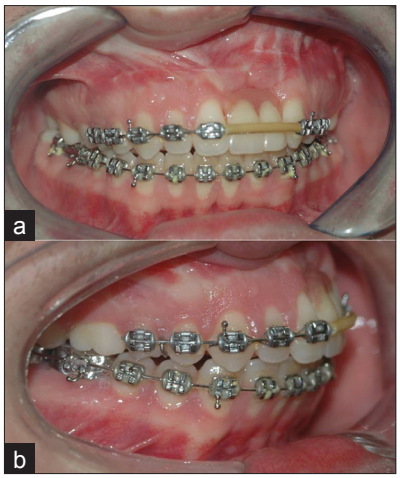

Figure 6: (a and b) The post distraction intraoral occlusal correction

In the treatment of severe hypoplastic cleft palate with conventional Le Fort I osteotomy the major advancement and the extreme discrepancies made stabilization difficult, and the added effect of palatal scarring can result in significant postsurgical relapse. In contrast, distraction osteogenesis provides an alternative method for maxillary advancement in patients with a great tendency to relapse, such as cleft palate patients. Experimental studies have demonstrated formation of mature lamellar bone by distraction osteogenesis.[11,17] In a study done on sheep, the maxilla was advanced 40 mm by distraction osteogenesis, with only 7% relapse at 1-year follow-up.[10] In another experimental study using dogs, cephalometric evaluation of 14 mm of maxillary advancement by maxillary distraction demonstrated stable results at 1-year follow-up.[18]

In a meta-analysis of cleft maxillary osteotomy and distraction osteogenesis based on 98 articles from 1966 to 2003,[19] Cheung and Chua found that 72 articles related to cleft maxillary osteotomy performed on 1,418 cleft patients, and that the other 26 articles described 276 cleft patients who had undergone maxillary distraction osteogenesis. This study concluded that distraction osteogenesis tends to be preferred to conventional osteotomy for younger cleft patients with more severe deformities. In such cases, it is feasible to use distraction to achieve moderate to large movement of the maxilla. More studies have demonstrated the efficiency of maxillary distraction over the conventional Le Fort I osteotomy.[12,20,21]

In cleft lip and palate the maxilla is hypoplastic in both anteroposterior and vertical directions. The instability of the Le Fort I maxillary segment in patients with cleft lip and palate manifests skeletally as retrusion of the maxilla because the main direction of surgical movement is forward and downward.

The use of distraction osteogenesis was proved as a predictable method for major bone elongation with generation of new bone in the distraction site.[8,9]

In the present study the method of maxillary distraction in severe maxillary retrusion was gradual advancement with slghts downward rotation of the maxilla permitting greater movement

and during this process concomitant new bone regeneration gradually became mature lamellar bone to maintain the final result. We conclude that distraction to correct the severe hypoplastic retruded cleft maxilla is superior to the conventional Le Fort I osteotomy.

After the period of growth with mild maxillary deficiency a one stage orthognathic surgery is preferable. However, in patients requiring moderate to large advancements with significant structural deficiencies of the maxilla or in growing patients the distraction technique is preferred.

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